

COVER SHEET (PAGE 1 of 2)

May 1998 CALFED ECOSYSTEM RESTORATION PROPOSAL SOLICITATION

Proposal Title: Development of an Optimal Design for Reducing Predation on Small Delta Fishes at a Large Fish Screen
 Applicant Name: M. Levent Kavvas, University of California, Davis
 Mailing Address: UC Davis, CML & Env. Engineering Dpt., One Shields Avenue, Davis, CA 95616
 Telephone: (530) 752-2518
 Fax: (530) 752-2385

Amount of funding requested: \$ 778,424 for 2 years

Indicate the Topic for which you are applying (check only one box). Note that this is an important decision: see page 30 of the Proposal Solicitation Package for more information.

- | | |
|---|---|
| <input type="checkbox"/> Fish Passage Assessment | <input type="checkbox"/> Fish Passage Improvements |
| <input checked="" type="checkbox"/> Floodplain and Habitat Restoration | <input type="checkbox"/> Gravel Restoration |
| <input type="checkbox"/> Fish Harvest | <input type="checkbox"/> Species Life History Studies |
| <input type="checkbox"/> Watershed Planning/Implementation | <input type="checkbox"/> Education |
| <input type="checkbox"/> Fish Screen Evaluations - Alternatives and Biological Priorities | |

Indicate the geographic area of your proposal (check only one box):

- | | |
|---|---|
| <input type="checkbox"/> Sacramento River Mainstem | <input type="checkbox"/> Sacramento Tributary: _____ |
| <input checked="" type="checkbox"/> Delta | <input type="checkbox"/> East Side Delta Tributary: _____ |
| <input type="checkbox"/> Suisun Marsh and Bay | <input type="checkbox"/> San Joaquin Tributary: _____ |
| <input type="checkbox"/> San Joaquin River Mainstem | <input type="checkbox"/> Other: _____ |
| <input type="checkbox"/> Landscape (entire Bay-Delta watershed) | <input type="checkbox"/> North Bay: _____ |

Indicate the primary species which the proposal addresses (check no more than two boxes):

- | | |
|--|--|
| <input type="checkbox"/> San Joaquin and East-side Delta tributaries fall-run chinook salmon | |
| <input type="checkbox"/> Winter-run chinook salmon | <input type="checkbox"/> Spring-run chinook salmon |
| <input type="checkbox"/> Late-fall run chinook salmon | <input type="checkbox"/> Fall-run chinook salmon |
| <input checked="" type="checkbox"/> Delta smelt | <input type="checkbox"/> Longfin smelt |
| <input checked="" type="checkbox"/> Splittail | <input type="checkbox"/> Steelhead trout |
| <input type="checkbox"/> Green sturgeon | <input type="checkbox"/> Striped bass |
| <input type="checkbox"/> Migratory birds | |

COVER SHEET (PAGE 2 of 2)

May 1998 CALFED ECOSYSTEM RESTORATION PROPOSAL SOLICITATION

Indicate the type of applicant (check only one box):

- | | |
|--|---|
| <input type="checkbox"/> State agency | <input type="checkbox"/> Federal agency |
| <input type="checkbox"/> Public/Non-profit joint venture | <input type="checkbox"/> Non-profit |
| <input type="checkbox"/> Local government/district | <input type="checkbox"/> Private party |
| <input checked="" type="checkbox"/> University | <input type="checkbox"/> Other: _____ |

Indicate the type of project (check only one box):

- | | |
|--|---|
| <input type="checkbox"/> Planning | <input type="checkbox"/> Implementation |
| <input type="checkbox"/> Monitoring | <input type="checkbox"/> Education |
| <input checked="" type="checkbox"/> Research | |

By signing below, the applicant declares the following:

- (1) the truthfulness of all representations in their proposal;
- (2) the individual signing the form is entitled to submit the application on behalf of the applicant (if applicant is an entity or organization); and
- (3) the person submitting the application has read and understood the conflict of interest and confidentiality discussion in the PSP (Section II.K) and waives any and all rights to privacy and confidentiality of the proposal on behalf of the applicant, to the extent as provided in the Section.



(Signature of Applicant)

EXECUTIVE SUMMARY

A. Project Title and Applicant Name

DEVELOPMENT OF AN OPTIMAL DESIGN FOR REDUCING PREDATION ON SMALL DELTA FISHES AT A LARGE FISH SCREEN

Dr. M. Levent Kavvas, UC Davis

Dr. Joseph J. Cech, Jr., UC Davis

B. Project Description and Primary Biological/Ecological Objectives

The objective of this project is to develop and evaluate generic sieving designs for the exclusion of the fish predators near large fish screens and, for each screen configuration, quantify predator exclusion, and the passage success, survival, and behavior of several priority Delta fishes. This project addresses a major environmental stressor identified by CALFED, alteration of flows and effects of water management activities, and associated predation mortality of priority species. The project is specifically designed to quantitatively evaluate the effectiveness of one of CALFED's primary mitigation strategies for fish protection, installation of fish screens, and to produce results which may be implied to improve fish passage and survival at fish screens, including those proposed under the CALFED alternatives. Specific questions addressed include:

How vulnerable are small Delta fishes to predation?

Can predation rates be reduced if sorting screens are present?

How many of sorting screens are necessary to effectively reduce predation?

What is the optimal configuration of these sorting screens?

Answers to these questions will assist engineers and water managers to make decisions regarding screening of diversions and apply adaptive management techniques in water diversions operation which protect fish and enhance ecosystem quality.

C. Approach/Tasks/Schedule

The approach is to test several small-size priority Delta fish species (chinook salmon parr and smolts, delta smelt, and splittail young-of-the-year) in clear water conditions, to quantitatively observe and track their movements and responses to the diversion, fish screen, sorting screens, bypass, and predators. These results will then allows us to develop an effective fish screen facility design for reducing predation. Experiments will be conducted in a large, laboratory-based flume (see Figure 1.) in which hydraulic (e.g. flow rate, approach and sweeping velocity) and biological (e.g. number of predators) conditions can be controlled and the behavior of the fishes can be closely observed and recorded.

The 24-month project is scheduled in 2 phases. Phase I (9 months) will include modifications of the flume, and design, construction and installation of fish sorting screen set along with the standard fish screen, and preparation of a Quality Assurance Project Plan (QAPP) for biological tests. Hydraulic and biological tests will be conducted during Phase II (15 months).

D. Justification for Project and Funding by CALFED

Installation of fish screens at water diversions has been identified by CALFED as an activity that provides direct benefit to fish resources and the ecosystem. However, predation losses of bypassed fishes may substantially reduce any fish protective benefits imparted by installation of the screen. The proposed project will develop and evaluate generic sieving designs for the exclusion of fish predators near large fish screens. This project may be funded under the CALFED program for several reasons:

1. It addresses questions and will produce information applicable to mitigate problems in the Sacramento-San Joaquin Delta and river system associated with alteration of flows, effects of

water management activities, and predation mortality of priority fish species, key high rank stressor identified by CALFED.

2. It specifically addresses one of the nine topics identified by CALFED as a priority problem in the Bay-Delta ecosystem, fish passage and related screen improvements, and has direct relevance to at least one other topic, fish passage assessment.
3. It will provide information directly applicable to the design and operation of proposed large-scale diversions outlined in the CALFED long-term plan alternatives.
4. It focuses on priority species that are documented to be at high risk from the stressor.

E. Budget Costs and Third Party Impacts

Total funding requested from CALFED is \$778,424 for 24 months. This amount includes funds for equipment, supplies, and labor for flume modifications, salaries and benefits of personnel, travel, publication costs, and overhead rate of 44.5%. Additional support will be provided by our funding partners, including UC Davis, DWR and DFG.

F. Applicant Qualifications

Dr. M. Levent Kavvas is a professor at University of California, Davis. He has been responsible for many research projects in the areas of hydraulic and hydrologic engineering, in collaboration with different state agencies. He is currently a principal investigator on the Fish Treadmill study, an extensive study of the performance and behavior of Delta fishes exposed to 3-D flow fields near large flat plate fish screens.

Dr. Joseph J. Cech, Jr., is a professor at University of California, Davis, and a well recognized authority on physiology and behavior of fishes. He has successfully completed seven state agency contracts, many with an emphasis on Delta and riverine fishes. He is currently co-principal investigator on the Fish Treadmill study.

G. Monitoring and Data Evaluation

Project results will be reported in regularly submitted quarterly, annual and final reports. Results will also be submitted for publication in peer-reviewed scientific journals, presented at interagency workgroup meetings, and will be available for public review. Biological data collection and evaluation will be described thoroughly in a Quality Assurance Project Plan prepared by the co-principal investigator and research staff and reviewed and approved by experts from collaborating agencies

H. Local Support/Coordination with other Programs/Compatibility with CALFED

Objectives

Most of the infrastructure and capital equipment required for the studies is already available at UCD Hydraulics Laboratory, UCD Aquatic Center and UCD Fish Environmental Biology Laboratory. Extensive cooperative and collaborative research and funding arrangements exist between the applicant, other UCD researchers, and state agencies (e.g. DWR, DFG). This project complements several ongoing field and laboratory based projects investigating fish responses to fish screens, fish screen effectiveness, and fish screen hydraulic performance and will provide information directly applicable to implementation of the CALFED alternatives.

TITLE PAGE

**Title of project: DEVELOPMENT OF AN OPTIMAL DESIGN FOR
REDUCING PREDATION ON SMALL DELTA FISHES AT A LARGE
FISH SCREEN**

Principle Investigator: M. Levent Kavvas, Professor
Department of Civil and Environmental Engineering
University of California, Davis
One Shields Avenue
Davis, CA 95616
(530) 752-2518, FAX (530) 752-2385, mlkavvas@ucdavis.edu

Type of Organization and Tax Status: State assisted public research and
educational institution

Tax Identification Number: 94-603-6494

Participants/Collaborators in Implementation:

Joseph J. Cech, Jr., Professor
Department of Wildlife, Fish, and Conservation Biology
University of California, Davis
One Shields Avenue
Davis, CA 95616
(530) 752-3103, FAX (530) 752-4154, jjcech@ucdavis.edu

California Department of Water Resources
California Department of Fish and Game
National Marine Fisheries Services

PROJECT DESCRIPTION

A. Project Description and Approach

1. Introduction

Entrainment, impingement, and predation losses of many small Delta fishes at screened and unscreened water diversions have contributed to the declines of many resident and Delta transient fishes, including the threatened delta smelt and endangered winter run chinook. Installation of fish screens has been shown to exclude fishes from diverted water (i.e., reduce entrainment losses of fishes >5mm in length, IEP Technical Report 37, 1994). However, substantial anecdotal and experimental evidence suggests that predation on small fishes that are entrained in the flow field at a fish screen, passing a fish screen, or exiting a fish bypass may be extremely high. In some instances, particularly at large diversion facilities such as the Central Valley Project or State Water Project, as well as those proposed in the CALFED alternatives, predation losses of fishes at fish screens may nullify any beneficial effects of reduced entrainment losses provided by the fish screen installation. Understanding the unintended secondary effects of installation of fish screens is essential to the CALFED mission of ecosystem restoration, enhancing fish populations (including fish doubling goals mandated by the CVPIA), and developing an effective screen design and operational strategies for existing and future large-scale water diversions.

The presence of the fish screen increases the structural complexity of the environment, providing an area where maximum foraging efficiencies and the highest densities of predators could occur. The fish are concentrated in the bypass areas and near the end of the screen making them an easy prey for piscivorous fishes. The speedy transit of fish through the screen will reduce opportunities for predators. The potential loss of juvenile fish to predation is a serious consideration in the design and operation of fish screens. Concentration and stressing of small fish near screens and accumulation of predator fish around screen structures are undesirable effects of the diversion and screening of water. Conditions that increase prey vulnerability or enhance predator opportunities must be understood in order to develop facilities that minimize fish losses. One way to minimize losses due to the predation would be to employ the sieving technique. A gradual exclusion of large fish predators is possible by placing sorting screens with different sizes of openings in a series one behind another, starting with the coarsest screen. Small fish are then exposed to the fish screen and bypassed back into the river.

We propose to evaluate different generic configurations (at the most 4 at the current level of funding) of these screens under various flow conditions in order to determine the one configuration that is the most efficient in reducing predation of small Delta fishes near fish screens. For each configuration, we will quantitatively evaluate the passage success, survival, and behavioral responses of several small-size priority fish species (e.g., chinook salmon parr and smolts, delta smelt, splittail young of the year), and the effectiveness of the screen configuration for separating the large predator fish from smaller fish. These test will be performed in a large laboratory based flume under construction at the UC Davis Hydraulics Laboratory.

Our results will assist CALFED and other environmental and resource managers to make decisions regarding the design and operation of screened water diversions in ways which truly protect fish, and enhance ecosystem quality, and contribute to fish doubling goals mandated by the CVPIA.

Since this design study is generic in nature and performed at a large laboratory flume, the optimal configuration to be developed for the set of fish screens for minimizing fish predation can then be applied at any particular diversion location. In addition, this project complements other ongoing and proposed projects to evaluate fish screen effectiveness, including the fish treadmill project (DWR

contract #B-80898), a detailed investigation of the behavior and performance of Delta fishes exposed to large flat-plate fish screens.

2. Objective

The objective of the project is to develop and evaluate generic sieving designs for the exclusion of the fish predators near large fish screens and, for each screen configuration, quantify predator exclusion, and the passage success, survival, and behavior of several priority Delta fishes.

3. Methods

Various configurations (at the most 4) for the set of fish screens for reducing fish predation will be evaluated at a large scale flume that is being constructed at the Hydraulics Laboratory of the University of California, Davis. The apparatus is designed to provide controlled hydraulic and environmental conditions and a fish screen installation similar to those used at many large size water diversions, and similar to design being considered for the CALFED alternatives. This approach will enable us to test selected Delta fishes in clear water conditions, to quantitatively observe and track their movements and responses to the diversion, fish screen, sorting screens, bypass, and predators.

Flume Apparatus: The flume will be located at the Hydraulics Laboratory behind the existing Sacramento River model. It is 50 ft long with two control sections on both ends that are 16 ft and 9 ft long respectively. Flume is 12 ft wide and 6 ft high, and it is made of 1/4" thick steel plates. The flume rests on a reinforced concrete slab which has sufficient width in order to accommodate the expansion of the flume if necessary. The walls of the flume are braced with 4" channel irons that form truss support. Water will be circulated in the flume using pumps that are capable of moving 60 cubic feet per second of water. Water is pumped through 24" diameter steel pipes that are laid on the slab next to the flume. One pipe is equipped with a return pipe and 24" butterfly valve. Discharge is controlled using the return pipe. Water, after entering the control section, flows through a baffle consisting of expanded metal sheets filled with gravel. The purpose of the baffle is to effectively dissipate and minimize the turbulence in the water. Different water depths in the flume channel will be achieved using a control gate at the downstream end of the flume. Water is collected in the downstream control section and pumped back through the pipes. A diagram of the proposed design and experimental setting is given in Figure 1.

Design/Experimental Protocol: Hydraulic studies will be performed for each different screen configuration and flow combination. Detailed velocity measurements will be performed to quantify the flow field in the flume. These measurements will help us gain better understanding of flow conditions near the sorting screens and a fish screen. Measurements will allow us to evaluate the angle and position of the screens in order to achieve an optimal design. Biological experiments will be performed for each different screen configuration and flow combination. Each experiment with the fish will consist of an initial pre-test, habituation period during which approach flow = 0 f/s, and a test period during which the water will flow through the diversion at the prescribed rate. Our preliminary plans call for 1 hour pre-test period and a 0.25-1 hour test period but these periods may be modified depending on results of pilot studies. For each experiment, 20-40 fish will be used (final group size for each species to be determined by pilot studies) and, in experiments with predators, one to four striped bass (*Morone saxatilis*, >0.5 kg in weight, final number to be determined by pilot studies).

Species: While a number of small-size Delta and riverine fishes are thought to be adversely affected by agricultural diversions, priority for these experiments will be:

1. chinook salmon parr and smolts;
2. delta smelt;
3. splittail young-of-the-year.

Because most of these fish are available in adequate numbers only during certain season, each screen configuration may not be tested with all species. Other species (e.g., steelhead) may be tested

if adequate numbers of fish are available and/or field data from cooperating agencies suggest these fish are at greater risk from predation.

Flow velocities: Experiments will be conducted at two approach flow velocities, 0.2 f/s (6 cm/s, the present criteria for delta smelt) and 0.33 f/s (10 cm/s, the present criteria for chinook salmon) and a control flow condition, 0 f/s, with different sweeping velocities.

Environmental Conditions: Experiments will be conducted during the late winter, spring, and fall at ambient temperatures, 12-20°C (estimated seasonal range).

Hydraulic Measurements: Three dimensional water velocity flow field measurements will be performed prior to the beginning of the biological experiments. During the biological experiments single point flow measurements will be used as a quality control feature.

Water velocity will be measured using the SonTek Acoustic Doppler Velocimeter. This instrument is capable of measuring turbulent velocities at a rate of up to 25 samples per second. It measures velocity in three directions and allows for qualitative assessment of turbulence structures in the flow field near the fish screens.

Biological Measurements: Fish behavior and responses to the diversion will be monitored during each experiment visually by researchers as well as recorded by four 60 frame/s video cameras mounted in stationary locations above the fish screens and bypasses. Recordings from each camera will be analyzed manually and using a computer-assisted motion analysis. For each video record, information on flow velocities and directions, fish size, and linear scaling will be incorporated into the computer program and/or data record for calibration purposes. Measurements will include fish orientation, location within the apparatus (e.g., distance from screen surface), swimming velocity, distance and direction traveled, passage through or impingement on a screen, time to bypass, % of fish bypassed, and predation events. Fish orientation, and distance, direction and velocity traveled over the ground will be combined with velocity-vector maps of the flume to calculate true swimming velocities and distance traveled through the water by individual fish. Survival will be monitored during all experiments and for a minimum of 24 h post-test in fresh water.

B. Proposed Scope of Work

The proposed project consists of two phases:

Phase I (duration: 9 months)

- acquisition of equipment and materials;
- modifications of the flume and water delivery system in order to accommodate various flow conditions found in the Sacramento-San Joaquin Delta;
- design, construction and installation of fish sorting screens set along with the standard fish screen;
- preparation and approval of a Quality Assurance Project Plan (QAPP) for biological tests;

Phase II (duration 15 months)

- detailed flow velocity fields will be studied and quantified;
- biological studies under different fish screen configurations and flow conditions;
- final data analysis and interpretation, including comparisons of results with complementary data from other ongoing field and laboratory fish screen studies;
- report writing.

Results of the studies will be reported in quarterly progress and financial reports, and a final report will be submitted at the end of Phase II.

C. Location of the Project

The species, stressors and habitats addressed in this project are located in all areas within the Sacramento-San Joaquin Delta and river system that are affected by existing and proposed large-

scale screened water diversions and fish bypasses. The project will be executed at the Hydraulics Laboratory of the University of California in Davis, which is located near the Sacramento-San Joaquin Delta. The Delta fish will be collected and transported to the Hydraulics Laboratory for the actual design studies.

D. Expected Benefits

This project addresses problems in the Sacramento-San Joaquin Delta and tributaries. It evaluates the effects of fish predation near fish screens on several priority fish species that are at the greatest risk of decline: chinook salmon and delta smelt (primary species, 1st tier) and splittail (primary species, 2nd tier).

Installation of fish screens at water diversions has been identified by CALFED as an activity that provides direct benefit to fish resources and the ecosystem. However, predation losses of entrained, impinged, and bypassed fishes may substantially reduce any fish protective benefits imparted by installation of the screen. The proposed project will develop and evaluate generic sieving designs for the exclusion of fish predators near large fish screens. The results of this project will help in developing better fish screens, screens that exclude or divert predators. Such screens can help reduce predation losses near diversion facilities. The passage success of several priority Delta fish species will be quantitatively evaluated, and the efficacy of several water diversion designs and operational strategies will be put to test. The results will have application and provide benefit to several habitat types, including tidal perennial aquatic habitat, instream aquatic habitat, and shaded riverine habitat, and all fishes which reside in or pass through these habitats. This project will specifically evaluate passage success, and entrainment, impingement and predation losses of several priority fish species, chinook salmon, delta smelt, and splittail, thought to be a high risk from water diversion related stressors. Results may be applicable to predict diversion and screen impacts on other ecologically and/or morphologically similar species not tested (e.g., steelhead, longfin smelt, striped bass).

Understanding of the unintended secondary effects of installation of fish screens is essential to the CALFED mission of ecosystem restoration, enhancing fish populations (including fish doubling goals mandated by the CVPIA), providing information and tools for effective adaptive management by agencies and water users, and implementing the CALFED alternatives. Finally, this apparatus, once developed, will also be useful for studies on the effects of other environmental and biological conditions (e.g., temperature, turbidity, salinity, fish size, other species) and different screen types. This flume apparatus is not site specific but it is rather a generic apparatus where various fish screening alternatives can be tested and evaluated.

E. Background and Ecological/Biological/Technical Justification

Installation of fish screens at existing large water diversions (e.g., CVP) and at possible future diversions proposed as components of the CALFED long term plan alternatives has been identified by CALFED as an activity which provides a direct benefit to fish resources and the ecosystem. However, substantial evidence suggests that large numbers of screened and bypassed fishes may be instead lost to predation. The direct benefit attributed to screen installation may be minimal. Physical models, such as the proposed flume, allow an insight into flow discontinuities, head losses, effects of submerged screens, operational flexibility and ability to meet velocity criteria under all possible conditions. Past experience with physical model studies has been that they are often started too late to be of full benefit in the planning process. Therefore the infrastructure to support physical modeling studies needs to be in place prior to initiating detailed modeling studies. That is where the proposed project falls in.

The proposed project will quantitatively evaluate the passage success and vulnerability to predation of priority Delta fishes, and test the effectiveness of several screen configurations designed to

exclude and divert predatory fishes and thus reduce predation losses of small size priority species. It addresses specific ERPP objectives as outlined below:

1. Continued research on fish screening and related facilities design and operations, and on fish behavior relative to screening (ERPP v.1, Vision for Water Diversions, p. 277);
2. Reduction of adverse effects of CVP and SWP diversions during the period when larvae, juvenile, or adult life stages of Delta smelt appear in the Delta (ERPP v.1, Vision for Delta smelt, p. 136);
3. Removal of predators associated with diversions and fish protection facilities (ERPP v.1, Vision for splittail, p. 144);
4. Elimination of stressors that cause direct or indirect mortality of chinook salmon (ERPP v.1, Vision for chinook salmon, p. 154).

In addition, through its focus on chinook salmon (project results should be applicable to all runs), this project also addresses objectives of the Anadromous Fish Restoration Program and other sections of the CVPIA. Our results will provide CALFED and other environmental managers and water users with information essential to make decisions regarding screening and operation of large water diversions that, by protecting fishes, enhance ecosystem functioning and quality.

This experimental approach and use of a laboratory-based system for a biological evaluation of the fish protection qualities of fish screens is preferable to field studies and will provide greater direct benefit than field studies for several reasons.

- 1) The flume under construction at UC Davis Hydraulics Laboratory is generic in design. It is not site specific and it allows for testing of different screen configurations. Rate of flow, approach and sweeping velocities are easily controllable and therefore different combinations can be tested. The flume can also be widened from current 12 feet up to the 32 feet width. There is also a space for longitudinal extension of the flume. The flume with this modular design, lends itself to a wide array of studies. Various scaled models can be put into the flume and tested as well as some 1:1 studies of diversion and fish screening sites.
- 2) Observations of fishes near fish screens installed at water diversions in the Delta or rivers are logistically and technically difficult (e.g., turbid water conditions limit visibility for human or video observations).
- 3) The presence, numbers, species, and sizes of fishes near any particular diversion are not predictable and cannot be replicated, therefore development of a scientifically and statistically valid study to assess screen effectiveness is difficult. Artificial introduction of test fish (including mark, release and recapture studies) near the diversion and screen is problematic because the effects of exposure to the diversion and predators cannot be easily separated from the stressful effects of handling and release, and these stressed fish may respond differently to the diversion than unhandled fish.
- 4) Hydraulic (e.g. flow rates, approach and sweeping velocities), environmental (e.g., temperature, light levels) and biological conditions (e.g., number and type of predator) are inherently uncontrolled in the field and cannot be replicated or tested quantitatively.

While the proposed project is new, it continues the applied research interest and collaborative activities of our laboratory on the effects of flows, fish screens, and environmental conditions on the performance, behavior, and physiology of Delta fishes. Much of the required laboratory, fish holding, and hydraulic facilities and infrastructure are in place and available (see G.

Implementability: Facilities). This project capitalizes on a number of existing and new cooperative and collaborative arrangements between our hydraulic engineering research group, applied environmental biology research group, state and federal resource agencies (e.g., DWR, DFG, USFWS, NMFS). It also complements several ongoing and proposed projects, including the Fish Treadmill project (DWR contract # B-80898).

F. Monitoring and Data Evaluation

Project results will be reported in regularly submitted quarterly, annual and final reports. Results will also be submitted for publication in peer-reviewed scientific journals in the appropriate fields, presented at interagency workgroup meetings, and will be available for public review. Data collection, acceptability, quality control, and evaluation will be described thoroughly in a Quality Assurance Project Plan prepared by the principal investigator, collaborating scientists, and research staff (including research collaborators from state and federal agencies) and reviewed and approved by one or more experts from these collaborating agencies who are not directly involved in the project.

G. Implementability

The proposed project is highly implementable. It utilizes existing facilities and resources at the University of California, Davis (UCD), as well as ongoing and productive collaborative arrangements with various state and federal agencies. It builds upon the expertise of scientists at University of California, Davis in areas of hydraulics and fish biology (including Delta fishes), and fish screen technology and operation (see *V. Applicant Qualifications*). There are no laws, regulations, land use conditions, hazardous materials concerns, etc. which would delay or preclude implementation of this project.

Facilities: The project will be executed at the UCD Hydraulics Laboratory where the flume will be constructed and all the experiments will take place. Experimental fishes will be maintained at the UCD Hydraulics Laboratory and Aquatic Center. UCD Fish Environmental Biology Laboratory will be utilized for analysis of fish behavioral and physiological data and samples. Videotape records from each experiment will be analyzed at the UCD Fish Environmental Biology Laboratory. Hydraulics Laboratory facilities include: a dedicated 265 ft deep well which provides non-chlorinated, air-equilibrated water, a temperature controlled fish holding facility, analytical equipment including 3-D velocimeter with downward and side looking probes, computers, and staff experienced in construction and hydraulic testing. Aquatic Center facilities include: a dedicated well which provides non-chlorinated, air-equilibrated water; a large scale, temperature-controlled fish holding facility (e.g., 23 tanks are available for this project); and an experienced staff for fish care and technical support. The Fish Environmental Biology Laboratory facilities include: computer-assisted motion analysis system, some video equipment, and computers with necessary database access and software.

Collaborative arrangements:

UCD Fish Environmental Biology Group: Assist in design of screen configurations, experimental design, implementation, analysis, and interpretation of biological experiments.

UCD Fish Pathology Laboratory (School of Veterinary Medicine): Fish disease diagnosis and treatment.

California Department of Water Resources (DWR): Consultation and assistance in design, construction and testing of the fish screen configurations.

California Department of Fish and Game (DFG): Consultation in the design of fish screen configurations, and assistance in fish collection and experiments.

National Marine Fisheries Services (NMFS): Consultation in the design of fish screen configurations and fish behavior experiments.

Permits: Required permits for water use and discharge, and animal collection and care are on file or being processed.

COSTS AND SCHEDULE TO IMPLEMENT PROPOSED PROJECT

A. Budget Costs

Total funding requested from CALFED is \$778,424 for 2 years (see Table 1.). Budget costs for Phase I include salaries and benefits of 1 Hydraulics Laboratory shop mechanic and 3 hydraulics engineers who will modify the flume and water supply system and install necessary sorting and fish screens. The budget cost for modifications and installations include sorting and fish screens, necessary plumbing and pumps for water supply system, additional fish holding tanks and associated plumbing, electrical installation, observation structure and a car-port type structure to cover the apparatus. Construction and installation of this type of apparatus at a facility without the water handling and fish holding infrastructure available at the UCD Hydraulics Laboratory would be more expensive. Budget costs for Phase II are mainly salaries and benefits for research and support staff, supplies and overhead.

Funding Partners: Collaborating agencies are expected to provide us with the part-time services of their personnel for different tasks (see Table 2.). California Department of Water Resources (participation pending) will provide us with a hydraulic engineer and biologist to consult and assist with the design, construction and testing of fish screen configurations, and to assist with the preparation of the QAPP. UC Davis is requesting from California Department of Fish and Game (participation pending) to provide equipment and in-kind services to assist in fish collection, design of fish screen configurations and preparation of QAPP.

Potential for Incremental Funding: Because the proposed project requires a moderately large capital outlay for modification of the flume before experiments can be initiated, and involves relatively long-duration and complex biological tests on live fishes which may only be available seasonally, the potential for incremental funding is limited. Biological experiments, particularly those designed to test several variables (e.g., fish species, day vs. night), require replication in order to produce scientifically and statistically valid results and are time consuming. Further, a commitment for the entire 24 months will facilitate attracting and keeping top-quality post-graduate researchers and maintaining a smoothly running program. Funding of this project will provide the State with a generic apparatus for various environmental studies. This is possible due to the modular design and expandability of the flume.

Table 1. Cost Breakdown of funding requested from the CALFED Program

	Phase I	Phase II	Total
Direct Salary and Benefits	104,849	256,014	360,863
Flume modifications materials and associated equipment	226,500	0	226,500
Miscellaneous supplies and equipment	0	11,400	11,400
Other direct costs (fees, travel, publication, etc.)	2,000	8,000	10,000
Overhead (44.5% of direct costs excluding equipment)	47,548	122,113	169,661
Total:	380,897	397,527	
	Grand Total: (2 years)		778,424

Table 2. Total funding for the project including counterparts from funding partners

	Phase I	Phase II	Total
University of California, Davis	19,500 ^a	19,500 ^a	39,000
Department of Water Resources	28,000 ^b	28,000 ^b	56,000
Department of Fish and Game	10,000 ^b	50,000 ^c	60,000
CALFED	380,897	397,527	778,424
Total:	438,397	495,207	933,424

Legend:

^a salary for M.L. Kavvas (15%) and J.J. Cech (5%)

^b estimated salaries of DWR and DFG personnel

^c salaries and equipment for fish collection

B. Schedule Milestones

Phase I

October 1998 Funding begins
Final design modifications, acquisition of equipment and materials,
modification of the flume and water delivery system, testing of the flume
Design and construction, and installation of fish sorting screens, installation
of standard fish screen
Water velocity measurements

May 1999 Begin fish collection

Phase II

July 1999 Conduct hydraulic and biological experiments with different combinations of
screens,
Water velocity measurements, flow mapping
Development of an optimal design
Fish collection as necessary
July 2000 Final data analysis and interpretation
Report writing
September 2000 Submit final report.

C. Third party impacts

Results from this study could have impact on the operational guidelines for fish screens and water diversions by suggesting techniques and approaches to minimize predation and better protect endangered Delta and riverine fishes. Application of the results of this proposed project could have impacts on sport, commercial and native Californian fisheries by improving protection of fishes at small water diversions throughout the Delta and the river system and thus enhancing fish populations.

APPLICANT QUALIFICATIONS

A. Organization of the Project

For over thirty years, the University of California Hydraulics Laboratory in Davis has been conducting hydraulic investigations through simulations and scaled models. The present and future research interests of the Hydraulics Laboratory are focused towards meeting the needs for the solution of the ecological, environmental and hydraulic engineering problems existing in the overall Delta region. Currently, Laboratory is conducting a Fish Treadmill study in order to determine how Delta fish species of various sizes and swimming abilities behave if subjected to a flat plate fish screen, and what are the suitable approach and sweeping velocities and screen exposure duration for various fish species.

The project will be under the direction and supervision of the principal investigator, Dr. M. Levent Kavvas, Professor in the Department of Civil and Environmental Engineering, University of California, Davis. Senior Development Engineer, Dr. J.J. DeVries will assist in the design and modifications of the flume, and will serve as a consultant to the research staff. Day to day project management, data analysis and interpretation, and report writing will be provided by the research engineer Dr. Z.Q. Chen. Two post-graduate research engineers will assist with design, construction, operation, and data collection and analysis. One part-time shop technician will assist in the construction of the related structures, as well as with the daily routine maintenance.

Biological studies will be under the direction and supervision of the co-principal investigator, Dr. J. J. Cech, Jr., Professor in the Department of Wildlife, Fish, and Conservation Biology, University of California, Davis. Day to day project management, implementation, data analysis, interpretation, and report writing will be provided by two post-graduate researchers, Drs. C. Swanson and P. S. Young. Part-time post-graduate researchers will assist with fish collection and care, and data collection and analysis. Collaborating engineers and biologists from DWR, DFG and NMFS will work with the principal investigators and managing hydraulic engineers and biologists.

B. Collaborating Scientists

Dr. M. Levent Kavvas is a professor at UC Davis, Civil and Environmental Engineering Department since 1985. He has been responsible for many related research projects in collaboration with different state agencies. He is an author of more than 87 journal and proceedings publications in the areas of hydraulic and hydrologic engineering. He has been a member of the Editorial boards of several engineering journals, and is currently the Editor of ASCE Journal of Hydrologic Engineering. He is currently a principal investigator on the Fish Treadmill study (DWR contract # B-80898), an extensive study of the performance and behavior of Delta fishes exposed to 3-D flow fields near large flat plate fish screens.

Dr. J.J. DeVries is a Senior Development Engineer on this project. He has more than 35 years of experience in hydraulic engineering, irrigation system analysis, and hydrology. He regularly teaches courses in hydraulic design and computer-based hydrologic modeling in the Department of Civil and Environmental Engineering, University of California, Davis. His recent experience includes working for consulting engineering firms (Failure Analysis Associates and Boyle Engineering Corporation), serving as the Northern Regional Coordinator and the Associate Director of the Water

Resources Center, University of California at Davis, as well as teaching and conducting research at the University in the fields of hydraulics, hydrology, open-channel flow, water science, and irrigation principles and practices.

Dr. Z. Q. Chen is a Research Engineer with the UCD Hydraulics Laboratory. He has worked on various hydraulic modeling studies, and currently is a lead engineer for the Fish Treadmill Project. He was also involved in the hydraulic modeling study of the Fish Treadmill 1:2.5 scale model. Dr. Chen specializes in computer models in hydrology, hydraulic analysis of rivers and solute transport, and physical hydraulic models.

Dr. Joseph J. Cech, Jr. has been a professor at UCD since 1975 and was Chair of the Department of Wildlife, Fish, and Conservation Biology from 1992-1997. He has published more than 80 peer-reviewed articles and books in the fields of physiology and physiological ecology of fishes, and has won numerous awards, honors, and grants. He has successfully completed seven contracts with state agencies for studies of the physiological ecology of fishes in the Sacramento-San Joaquin Delta and rivers. He is currently co-principal investigator, with M. L. Kavvas, Department of Civil and Environmental Engineering, UCD, on the Fish Treadmill Project (DWR contract # B-80898), a comprehensive study of the performance and behavior of Delta fishes exposed to 3-D flow fields and large flat-plate fish screens. Recent relevant publications include:

Cech, J. J., Jr., Mitchell, S. J., Castleberry, D. T., and McEnroe, M. (1990) Distribution of California stream fishes: influence of environmental temperature and hypoxia. *Env. Biol. Fish.* 29:95-105.

Moyle, P. B. and Cech, J. J., Jr. (1996) *Fishes: an introduction to ichthyology*. 3rd edition, Prentice Hall, Englewood Cliffs, New Jersey.

Cech, J. J., Jr., Bartholow, S. D., Young, P. S., and Hopkins, T. E. (1996) Striped bass exercise and handling stress in freshwater: physiological responses to recovery environment. *Trans. Am. Fish. Soc.* 125:308-320.

See also other co-authored publications listed below.

Dr. Christina Swanson has been a post-doctoral researcher in Dr. Cech's laboratory. She has spent the past five years studying the environmental tolerances, swimming performance, and behavior of Delta fishes, with an emphasis on the biology of delta smelt. She was the managing researcher on three successfully completed state contracts and is currently one of the managing biologists on the Fish Treadmill Project. Recent relevant publications include:

Swanson, C. and Cech, J. J., Jr. (1995) Environmental tolerances and requirements of delta smelt, *Hypomesus transpacificus*. Final Report for California Department of Water Resources, Contracts B-59449 and B-58959. 77 pp.

Swanson, C., Mager, R. C., Doroshov, S. I., and Cech, J. J., Jr. (1996) Use of salts, anesthetics, and polymers to minimize handling and transport mortality in delta smelt. *Trans. Am. Fish. Soc.* 125:326-329.

Swanson, C., Young, P. S., and Cech, J. J., Jr. (1996) Swimming studies on an estuarine fish: are performance indices the best tool to develop flow management criteria?. *Proceedings of the Applied Environmental Physiology of Fishes Symposium, International Congress on the Biology of Fishes, San Francisco State University, July 14-18, 1996*. Pp. 83-91.

Swanson, C., Young, P. S., and Cech, J. J., Jr. (1997) Swimming performance and behavior of delta smelt: maximum velocities, endurance, and kinematics in a laminar-flow swimming flume. Final Report for California Department of Water Resources Contract # B-59742. 67 pp.

Swanson, C., P. S. Young, and J. J. Cech, Jr. Swimming performance of delta smelt: maximal performance, and behavioral and kinematic limitations on swimming at submaximal velocities. *J. Exp. Biol.* 201: 333-345.

Dr. Paciencia S. Young received her doctoral training and is currently a post-doctoral researcher in Dr. Cech's laboratory. She is an expert in the areas of stress and exercise physiology of fishes and has spent the past four years studying the environmental tolerances, swimming performance, and behavior of Delta fishes, with an emphasis on the biology of splittail and delta smelt. She was the managing researcher on two successfully completed state contracts and is currently one of the managing biologists on the Fish Treadmill Project. Recent relevant publications include:
Young, P. S. and Cech, J. J., Jr. (1993) Effects of exercise conditioning on stress responses and recovery in cultured and wild young-of-the-year striped bass (*Morone saxatilis*). *Can. J. Fish. Aquat. Sci.* 50:2094-2099.

Young, P. S. and Cech, J. J., Jr. (1995) Environmental requirements and tolerances of Sacramento splittail, *Pogonichthys macrolepidotus* (Ayres). Final Report to the Interagency Ecological Studies Program for the San Francisco Bay/Delta. 56 pp.

Young, P. S. and Cech, J. J., Jr (1996) Environmental tolerances and requirements of splittail. *Trans. Am. Fish. Soc.* 125:664-678.

Mr. Ted Frink, a biologist with the Environmental Services Office, California Department of Water Resources, will consult and assist with us on design of different fish screen configurations, data analysis and interpretation of results.

Mr. Shawn Mayr, a civil engineer with the Environmental Services Office, California Department of Water Resources will assist and consult with us on design, construction and testing of the different fish screen configurations.

Mr. Robert Fujimura, a biologist with California Department of Fish and Game, will assist and consult with us on experimental design, data analysis and implementation of the experiments.

Mr. Rick Wantuck with National Marine Fisheries Services, will consult with us on the design of fish screen configurations and fish behavior experiments.

C. Conflict of Interest

There are no existing or potential conflicts of interests for any of the personnel involved in this project.

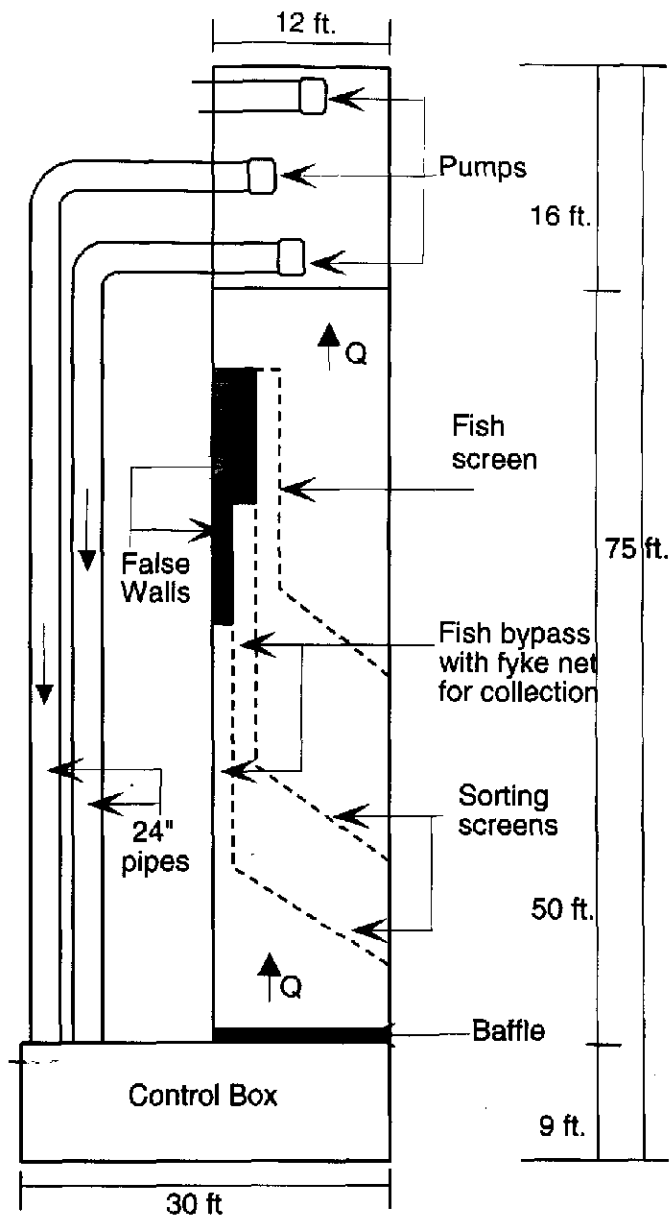


Figure 1. Diagram of the proposed design for predation study

U.S. Department of the Interior

**Certifications Regarding Debarment, Suspension and
Other Responsibility Matters, Drug-Free Workplace
Requirements and Lobbying**

Persons signing this form should refer to the regulations referenced below for complete instructions:

Certification Regarding Debarment, Suspension, and Other Responsibility Matters - Primary Covered Transactions - The prospective primary participant further agrees by submitting this proposal that it will include the clause titled, "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transaction," provided by the department or agency entering into this covered transaction, without modification, in all lower tier covered transactions and in all solicitations for lower tier covered transactions. See below for language to be used or use this form for certification and sign. (See Appendix A of Subpart D of 43 CFR Part 12.)

Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transactions - (See Appendix B of Subpart D of 43 CFR Part 12.)

Certification Regarding Drug-Free Workplace Requirements - Alternate I. (Grantees Other Than Individuals) and Alternate II. (Grantees Who are Individuals) - (See Appendix C of Subpart D of 43 CFR Part 12)

Signature on this form provides for compliance with certification requirements under 43 CFR Parts 12 and 18. The certifications shall be treated as a material representation of fact upon which reliance will be placed when the Department of the Interior determines to award the covered transaction, grant, cooperative agreement or loan.

PART A: Certification Regarding Debarment, Suspension, and Other Responsibility Matters - Primary Covered Transactions

CHECK ☒ IF THIS CERTIFICATION IS FOR A PRIMARY COVERED TRANSACTION AND IS APPLICABLE

- (1) The prospective primary participant certifies to the best of its knowledge and belief, that it and its principals:
 - (a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded by any Federal department or agency;
 - (b) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;
 - (c) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State or local) with commission of any of the offenses enumerated in paragraph (1)(b) of this certification; and
 - (d) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State or local) terminated for cause or default.
- (2) Where the prospective primary participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

PART B: Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transactions

CHECK ☐ IF THIS CERTIFICATION IS FOR A LOWER TIER COVERED TRANSACTION AND IS APPLICABLE

- (1) The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals is presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency.
- (2) Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

01-2010
June 1988
(This form replaces 01-1983, 01-1984,
01-1985, 01-1986 and 01-1987)

PART C: Certification Regarding Drug-Free Workplace Requirements

CHECK ☒ IF THIS CERTIFICATION IS FOR AN APPLICANT WHO IS NOT AN INDIVIDUAL

Alternate I. (Grantees Other Than Individuals)

A. The grantee certifies that it will or continue to provide a drug-free workplace by:

- (a) Publishing a statement notifying employees that the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance is prohibited in the grantee's workplace and specifying the actions that will be taken against employees for violation of such prohibition;
- (b) Establishing an ongoing drug-free awareness program to inform employees about—
 - (1) The dangers of drug abuse in the workplace;
 - (2) The grantee's policy of maintaining a drug-free workplace;
 - (3) Any available drug counseling, rehabilitation, and employee assistance programs; and
 - (4) The penalties that may be imposed upon employees for drug abuse violations occurring in the workplace;
- (c) Making it a requirement that each employee to be engaged in the performance of the grant be given a copy of the statement required by paragraph (a);
- (d) Notifying the employee in the statement required by paragraph (a) that, as a condition of employment under the grant, the employee will —
 - (1) Abide by the terms of the statement; and
 - (2) Notify the employer in writing of his or her conviction for a violation of a criminal drug statute occurring in the workplace no later than five calendar days after such conviction;
- (e) Notifying the agency in writing, within ten calendar days after receiving notice under subparagraph (d)(2) from an employee or otherwise receiving actual notice of such conviction. Employers of convicted employees must provide notice, including position title, to every grant officer on whose grant activity the convicted employee was working, unless the Federal agency has designated a central point for the receipt of such notices. Notice shall include the identification numbers(s) of each affected grant;
- (f) Taking one of the following actions, within 30 calendar days of receiving notice under subparagraph (d)(2), with respect to any employee who is so convicted —
 - (1) Taking appropriate personnel action against such an employee, up to and including termination, consistent with the requirements of the Rehabilitation Act of 1973, as amended; or
 - (2) Requiring such employee to participate satisfactorily in a drug abuse assistance or rehabilitation program approved for such purposes by a Federal, State, or local health, law enforcement, or other appropriate agency;
- (g) Making a good faith effort to continue to maintain a drug-free workplace through implementation of paragraphs (a) (b), (c), (d), (e) and (f).

B. The grantee may insert in the space provided below the site(s) for the performance of work done in connection with the specific grant:

Place of Performance (Street address, city, county, state, zip code)

Check ☐ if there are workplaces on file that are not identified here.

PART D: Certification Regarding Drug-Free Workplace Requirements

CHECK ☐ IF THIS CERTIFICATION IS FOR AN APPLICANT WHO IS AN INDIVIDUAL

Alternate II. (Grantees Who Are Individuals)

- (a) The grantee certifies that, as a condition of the grant, he or she will not engage in the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance in conducting any activity with the grant;
- (b) If convicted of a criminal drug offense resulting from a violation occurring during the conduct of any grant activity, he or she will report the conviction, in writing, within 10 calendar days of the conviction, to the grant officer or other designee, unless the Federal agency designates a central point for the receipt of such notices. When notice is made to such a central point, it shall include the identification number(s) of each affected grant.

PART E: Certification Regarding Lobbying
Certification for Contracts, Grants, Loans, and Cooperative Agreements

CHECK IF CERTIFICATION IS FOR THE AWARD OF ANY OF THE FOLLOWING AND
THE AMOUNT EXCEEDS \$100,000: A FEDERAL GRANT OR COOPERATIVE AGREEMENT;
SUBCONTRACT, OR SUBGRANT UNDER THE GRANT OR COOPERATIVE AGREEMENT.

CHECK IF CERTIFICATION IS FOR THE AWARD OF A FEDERAL
LOAN EXCEEDING THE AMOUNT OF \$150,000, OR A SUBGRANT OR
SUBCONTRACT EXCEEDING \$100,000, UNDER THE LOAN.


The undersigned certifies, to the best of his or her knowledge and belief, that:

- (1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of an agency, a Member of Congress, and officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
- (2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.
- (3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by Section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

As the authorized certifying official, I hereby certify that the above specified certifications are true.

THE REGENTS OF THE UNIVERSITY
OF CALIFORNIA


SIGNATURE OF AUTHORIZED CERTIFYING OFFICIAL
Sandra M. Dowdy
Contracts and Grants Analyst

TYPED NAME AND TITLE

DATE JUN 30 1998

APPLICATION FOR
FEDERAL ASSISTANCE

1. TYPE OF SUBMISSION Application <input type="checkbox"/> Construction <input checked="" type="checkbox"/> Non-Construction		2. DATE SUBMITTED 7/2/98	Application Identifier
Preapplication <input type="checkbox"/> Construction <input type="checkbox"/> Non-Construction		3. DATE RECEIVED BY STATE	State Application Identifier
		4. DATE RECEIVED BY FEDERAL AGENCY	Federal Identifier

5. APPLICATION INFORMATION

Legal Name The Regents of the University of California	Organizational Unit
Address (give city, county, state, and zip code) University of California, Davis Sponsored Projects Office 410 Mrak Hall, Yolo County Davis, CA 95616-8871	Name and telephone number of the person to be contacted on matters involving this application (give area code) Administrative Contact Technical Contact (530) 752-7405 (530) 752-2518 Stephanie Reynolds M. Levent Kavvas

6. EMPLOYER IDENTIFICATION NUMBER (EIN):

9	4	-	6	0	3	6	4	9	4
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3. TYPE OF APPLICATION:

☒ New ☐ Continuation ☐ Revision

If Revision, enter appropriate letter(s) in box(es) ☐ ☐

A. Increase Award B. Decrease Award C. Increase Duration
D. Decrease Duration Other (specify):

7. TYPE OF APPLICANT: (enter appropriate letter in box) ☐ I

- A. State H. Independent School Dist.
B. County I. State Controlled Institution of Higher Learning
C. Municipal J. Private University
D. Township K. Indian Tribe
E. Interstate L. Individual
F. Intermunicipal M. Profit Organization
G. Special District N. Other (Specify):

9. NAME OF FEDERAL AGENCY:

CALFED Bay-Delta Program

10. CATALOG OF FEDERAL DOMESTIC
ASSISTANCE NUMBER:

TITLE:

N/A

12. AREAS AFFECTED BY PROJECT (cities, counties, states, etc.)

United States

11. DESCRIPTIVE TITLE OF APPLICANT'S PROJECT:

Development of an Optimal Design for Reducing
Predation on Small Delta Fishes at a Large Fish
Screen

FDP-II

13. PROPOSED PROJECT:

Start Date	Ending Date
10/1/98	9/30/00

14. CONGRESSIONAL DISTRICTS OF:

a. Applicant	b. Project
III	III

15. ESTIMATED FUNDING:

1. Federal	\$ 380,897
2. Applicant	\$
3. State	\$
4. Local	\$
5. Other	\$
6. Program Income	\$
7. TOTAL	\$ 380,897

16. IS APPLICATION SUBJECT TO REVIEW BY STATE EXECUTIVE ORDER 12372 PROCESS?

- a. YES. THIS PREAPPLICATION/APPLICATION WAS MADE AVAILABLE TO THE
STATE EXECUTIVE ORDER 12372 PROCESS FOR REVIEW ON:
DATE _____
- b. NO. ☒ PROGRAM IS NOT COVERED BY E.O. 12372
☐ OR PROGRAM HAS NOT BEEN SELECTED BY STATE FOR REVIEW

17. IS THE APPLICANT DELINQUENT ON ANY FEDERAL DEBT?

- ☐ Yes If "Yes," attach an explanation. ☒ No

18. TO THE BEST OF MY KNOWLEDGE AND BELIEF, ALL DATA IN THIS APPLICATION/PREAPPLICATION ARE TRUE AND CORRECT THE DOCUMENT HAS BEEN DULY
AUTHORIZED BY THE GOVERNING BODY OF THE APPLICANT AND THE APPLICANT WILL COMPLY WITH THE ATTACHED ASSURANCES IF THE ASSISTANCE IS AWARDED

a. Typed Name of Authorized Representative	b. Title Sandra M. Dowdy Contracts and Grants Analyst	c. Telephone number (530) 752-2075
d. Signature of Authorized Representative <i>Sandra M. Dowdy</i>	e. Date Signed JUN 30 1998	

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I - 009753

Standard Form 424 (REV 4-88)
Prescribed by OMB Circular A-102

I-009753

Figure 2
Standard Form 424A

BUDGET INFORMATION - Non-Construction Programs

OMB Approval No. 0348-0044

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	Total (g)
1. CALFED		\$	\$	\$ 380,897	\$ 57,500	\$ 438,397
2. CALFED				397,527	97,500	495,207
3.						
4.						
5. Totals		\$	\$	\$ 778,424	\$ 155,000	\$ 933,424

6. Object Class Categories	GRANT PROGRAM FUNCTION OR ACTIVITY				Total (3)
	(1)	(2)	(3)	(4)	
a. Personnel	\$ 86,479	\$ 207,758	\$	\$	294,237
b. Fringe Benefits	18,370	48,256			66,626
c. Travel	1,000	2,000			3,000
d. Equipment	226,500	4,400			230,900
e. Supplies		7,000			7,000
f. Contractual					
g. Construction					
h. Other	1,000	6,000			7,000
i. Total Direct Charges (sum of 6a-6h)	333,349	275,414			608,763
j. Indirect Charges	47,548	122,113			169,661
k. TOTALS (sum of 6i and 6j)	\$ 380,897	\$ 397,527	\$	\$	\$ 778,424

7. Program Income	\$	\$	\$	\$	\$
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Standard Form 424A (Rev. 1-92)
Prescribed by OMB Circular A-102

1-009754

1-009754

Figure 2
Standard Form 424A (cont'd.)

SECTION C - NON-FEDERAL RESOURCES				
(a) Grant Program	(b) Applicant	(c) State	(d) Other Sources	(e) TOTALS
8.	\$ 155,000	\$	\$	\$ 155,000
9.				
10.				
11.				
12. TOTAL (sum of lines 8 - 11)	\$ 155,000	\$	\$	\$ 155,000

SECTION D - FORECASTED CASH NEEDS					
	Total for 1st Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
13. Federal	\$ 380,897	\$ 95,225	\$ 95,224	\$ 95,224	\$ 95,224
14. NonFederal	57,500	14,375	14,375	14,375	14,375
15. TOTAL (sum of lines 13 and 14)	\$ 438,397	\$ 109,600	\$ 109,599	\$ 109,599	\$ 109,599

SECTION E - BUDGET ESTIMATES OF FEDERAL FUNDS NEEDED FOR BALANCE OF THE PROJECT				
(a) Grant Program	FUTURE FUNDING PERIODS (Years)			
	(b) First	(c) Second	(d) Third	(e) Fourth
16.	\$	\$	\$	\$
17.				
18.				
19.				
20. TOTAL (sum of lines 16-19)	\$	\$	\$	\$

SECTION F - OTHER BUDGET INFORMATION	
21. Direct Charges: yr 1 = 380,897; yr 2 = 397,527	22. Indirect Charges: yr 1 = 44.5% and yr 2 = 46% of MTDC
23. Remarks:	

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Standard Form 424A (Rev. 4-92) Page 2

1-009755

1-009755

Budget (to be administered by the Department of Wildlife, Fish, and Conservation Biology)

Phase 1 (9 Months)

Personnel

1. Salaries and wages

Co-principal investigator (5%)	0
Post-graduate researcher VI (25% starting April 1999, 4 months)	3,300
Post-graduate researcher VI (25% starting April 1999, 4 months)	3,300
Subtotal	6,600

2. Staff benefits

Co-principal investigator (5%)	0
Post-graduate researcher VI (25% starting April 1999, 4 months)	825
Post-graduate researcher VI (25% starting April 1999, 4 months)	825
Subtotal	1,650

Travel (fish collection)	1,000
UCD Aquatic Center fees	1,000

SUBTOTAL	10,250
Indirect costs (44.5%)	4,561
TOTAL	14,811

Phase 2 (15 Months)

Personnel

1. Salaries and wages

Co-principal investigator (5%)	0
Post-graduate researcher VI (A, 25%, 15 months)	12,375
Post-graduate researcher VI (B, 25%, 15 months)	12,375
Post-graduate researcher I (C, 100%, 12 months)	32,400
Post-graduate researcher I (D, 100%, 12 months)	32,400
Post-graduate researcher I (E, 100%, 12 months)	32,400
2 student research assistants (10 h/wk, 12 months)	2,800
Subtotal	124,750

2. Staff Benefits

Co-PI	0
25% PGR A	3,094
25% PGR B	3,094
25% PGR C	8,100
25% PGR D	8,100

25% PGR E	8,100
Subtotal	30,488
Equipment (non-expendable)	
4 8 mm video cameras	3,200
2 8 mm VCRs	1,200
Total	4,400
Supplies	7,000
(fish collection and care supplies, office supplies, video tapes, plumbing and electrical supplies and repair, laboratory supplies, chemicals, etc.)	
UCD Aquatic Center fees	3,000
Travel (fish collection, workshops)	2,000
Publication costs	3,000
SUBTOTAL	174,638
Indirect costs (44.5% of \$170,238)	75,756
TOTAL	250,394
GRAND TOTAL Phase I and II	265,205

Figure 3
Standard Form 424B

OMB Approval No. 3348-0040

ASSURANCES — NON-CONSTRUCTION PROGRAMS

Public reporting burden for this collection of information is estimated to average 15 minutes per response, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the Office of Management and Budget, Paperwork Reduction Project (0348-0040), Washington, DC 20503.

PLEASE DO NOT RETURN YOUR COMPLETED FORM TO THE OFFICE OF MANAGEMENT AND BUDGET, SEND IT TO THE ADDRESS PROVIDED BY THE SPONSORING AGENCY.

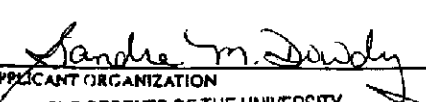
NOTE: Certain of these assurances may not be applicable to your project or program. If you have questions, please contact the awarding agency. Further, certain Federal awarding agencies may require applicants to certify to additional assurances. If such is the case, you will be notified.

As the duly authorized representative of the applicant I certify that the applicant:

1. Has the legal authority to apply for Federal assistance and the institutional, managerial and financial capability (including funds sufficient to pay the non-Federal share of project cost) to ensure proper planning, management and completion of the project described in this application.
2. Will give the awarding agency, the Comptroller General of United States, and if appropriate, the State, through any authorized representative, access to and the right to examine all records, books, papers, or documents related to the award; and will establish a proper accounting system in accordance with generally accepted accounting standards or agency directives.
3. Will establish safeguards to prohibit employees from using their positions for a purpose that constitutes or presents the appearance of personal or organizational conflict of interest or personal gain.
4. Will initiate and complete the work within the applicable time frame after receipt of approval of the awarding agency.
5. Will comply with the Intergovernmental Personnel Act of 1970 (42 U. S. C. §4728-4763) relating to prescribed standards for merit systems for programs funded under one of the nineteen statutes or regulations specified in Appendix A of OPM's Standards for a Merit System of Personnel Administration (5 C. F. R. 900, Subpart F).
6. Will comply with all Federal statutes relating to nondiscrimination. These include but are not limited to: (a) Title VI of the Civil Rights Act of 1964 (P.L. 88-352) which prohibits discrimination on the basis of race, color or national origin; (b) Title IX of the Education Amendments of 1972, as amended (20 U. S. C. §1681-1683, and 1685-1686), which prohibits discrimination on the basis of sex; (c) Section 504 of the Rehabilitation Act of 1973, as amended (29 U. S. C. §794), which prohibits discrimination on the basis of handicaps; (d) the Age Discrimination Act of 1975, as amended (42 U. S. C. §6101-6107), which prohibits discrimination on the basis of age; (e) the Drug Abuse Office and Treatment Act of 1972 (P.L. 92-255), as amended, relating to nondiscrimination on the basis of drug abuse; (f) the Comprehensive Alcohol Abuse and Alcoholism Prevention, Treatment and Rehabilitation Act of 1970 (P.L. 91-616), as amended, relating to nondiscrimination on the basis of alcohol abuse or alcoholism; (g) §§523 and 527 of the Public Health Service Act of 1912 (42 U.S.C. 290 dd-3 and 290 ee-3), as amended, relating to confidentiality of alcohol and drug abuse patient records; (h) Title VIII of the Civil Rights Act of 1968 (42 U.S.C. §3601 et seq.), as amended, relating to nondiscrimination in the sale, rental or financing of housing; (i) any other nondiscrimination provisions in the specific statute(s) under which application for Federal assistance is being made; and (j) the requirements of any other nondiscrimination statute(s) which may apply to the application.
7. Will comply, or has already complied, with the requirements of Titles II and III of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (P.L. 91-646) which provide for a fair and equitable treatment of persons displaced or whose property is acquired as a result of Federal or federally assisted programs. These requirements apply to all interests in real property acquired for project purposes regardless of Federal participation in purchases.
- X Will comply, as applicable, with provisions of the Hatch Act (5 U.S.C. §§1501-1508 and 7324-7328) which limit the political activities of employees whose principal employment activities are funded in whole or in part with Federal funds.

Figure 3
Standard Form 424B (cont'd.)

- 9. Will comply, as applicable, with the provisions of the Davis-Bacon Act (40 U.S.C. §§276a to 276a-7), the Copeland Act (40 U.S.C. §§276c and 18 U.S.C. §§374), and the Contract Work Hours and Safety Standards Act (40 U.S.C. §§327-333), regarding labor standards for federally assisted construction subagreements.
- 10. Will comply, if applicable, with flood insurance purchase requirements of Section 102(a) of the Flood Disaster Protection Act of 1973 (P.L. 93-234) which requires recipients in a special flood hazard area to participate in the program and to purchase flood insurance if the total cost of insurable construction and acquisition is \$10,000 or more.
- 11. Will comply with environmental standards which may be prescribed pursuant to the following: (a) institution of environmental quality control measures under the National Environmental Policy Act of 1969 (P.L. 91-190) and Executive Order (EO) 11514; (b) notification of violating facilities pursuant to EO 11738; (c) protection of wetlands pursuant to EO 11990; (d) evaluation of flood hazards in floodplains in accordance with EO 11988; (e) assurance of project consistency with the approved State management program developed under the Coastal Zone Management Act of 1972 (16 U.S.C. §§1451 et seq.); (f) conformity of Federal actions to State (Clear Air) Implementation Plans under Section 176(c) of the Clear Air Act of 1955, as amended (42 U.S.C. §§ 7401 et seq.); (g) protection of underground sources of drinking water under the Safe Drinking Water Act of 1974, as amended, (P.L. 93-523); and (h) protection of endangered species under the Endangered Species Act of 1973, as amended, (P.L. 93-203).
- 12. Will comply with the Wild and Scenic Rivers Act of 1968 (16 U.S.C. §§1271 et seq.) related to protecting components or potential components of the national wild and scenic rivers system.
- 13. Will assist the awarding agency in assuring compliance with Section 106 of the National Historic Preservation Act of 1966, as amended (16 U.S.C. 470), EO 11593 (identification and protection of historic properties), and the Archaeological and Historic Preservation Act of 1974 (16 U.S.C. 469a-1 et seq.).
- 14. Will comply with P.L. 93-348 regarding the protection of human subjects involved in research, development, and related activities supported by this award of assistance.
- 15. Will comply with the Laboratory Animal Welfare Act of 1966 (P.L. 89-544, as amended, 7 U.S.C. 2131 et seq.) pertaining to the care, handling, and treatment of warm blooded animals held for research, teaching, or other activities supported by this award of assistance.
- 16. Will comply with the Lead-Based Paint Poisoning Prevention Act (42 U.S.C. §§ 4801 et seq.) which prohibits the use of lead based paint in construction or rehabilitation of residence structures.
- 17. Will cause to be performed the required financial and compliance audits in accordance with the Single Audit Act of 1984 or OMB Circular No. A-133, Audits of Institutions of Higher Learning and other Non-profit Institutions.
- 18. Will comply with all applicable requirements of all other Federal laws, executive orders, regulations and policies governing this program.

SIGNATURE OF AUTHORIZED CERTIFYING OFFICIAL 	TITLE Sandra M. Dowdy Contracts and Grants Analyst
APPLICANT ORGANIZATION THE REGENTS OF THE UNIVERSITY OF CALIFORNIA	DATE SUBMITTED JUN 30 1989